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Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: 1953 TEST STORAGE INPUT PROGRAM

To: S&EC Group, Group 61, Systems Group

From: J. Frankovich

Date: 7 April 1953

Abstract: A revision of the standard Test Storage contents is being made. A short drum output-input program will replace the present 5-56 input program. The new program will work in conjunction with a 5-56 input program, a basic conversion program, and facilities associated with the Comprehensive System, all stored permanently in drum group 7. Existing tapes need not be changed, except that feedout, preceded by a special character, must appear every 25 feet on 5-56 tapes. The program will be installed immediately in registers 32-37 (octal) along with the present 5-56 program to allow a transition period. Registers 3-31(octal) will be changed at the discretion of Group 61 after May 1, 1953. Registers 0, 1 and 2 will remain unchanged, containing +0, +2⁻¹⁵ and FF 2 respectively. All programs which refer to Test Storage registers 3-31(octal) must be changed by May 1. Note especially that sp 25 used in a program to read in new tape must now be sp 32(octal).

Introduction

The incorporation of the auxiliary drum into the WWI system and the scheduled use of most of Test Storage by Group 61 make an alteration of the present Test Storage 5-56 input program (DL-615) both desirable and necessary. Group 61 and the S&EC Group will suffer least from whatever changes are made if no effective change is made in the present 5-56 structure of binary information on paper tape nor in the operational procedures for reading their tapes into WWI (see E-473). In addition it is possible for both groups to profit by making use of semi-permanently recorded ("locked out") drum groups to store more general input programs for use in conjunction with a new TS program. Several members of both applications groups have agreed upon the scheme proposed here, taking into account the requirements of the two groups. Criticisms of the proposals should be forwarded immediately to the writer of this note.

Requirements for a new Test Storage Input Program

One ability required by Group 61 is that of being able to read into ES a master control program from the drum immediately after a disabling parity alarm. The TS program must accomplish this without disturbing the contents of the Flip Flop registers in TS.

A second ability, required by both applications groups, is of being able to read into ES binary information from paper tape in PETR. This need not be accomplished directly by the TS program; it can use a suitable program stored on the drum. The program on the drum must be read into ES by the TS program.

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Both groups, particularly the S&EC Group, would also like to have the TS program record unaltered all of the contents of ES on the drum. This ability would permit use of 5-56 modification and parameters and would simplify post-mortem. The TS program would have to perform this directly.

The Proposed Program

The proposed TS input program (see attached sheet DL- 687) will, in conjunction with a general input program on group 7 of the drum, provide the desired abilities. Group 7 will be assumed "locked out". Other of the abilities of the present 5-56 input program were ignored while writing the new program. Some, such as the ease with which a program can go to the input program to read in new sets of parameter tapes for further calculation, can be preserved by proper design of the general input program. Others, such as the ability to read in from magnetic tape, can not be regained without some loss on the programmer's part. Also, long 5-56 tapes must have additional special characters inserted to enable them to be read in.

The new program will occupy the last six registers of TS. It will be installed now with only one change in the present 5-56 program. The modified 5-56 input program will not be able to skip positively tagged blocks of information on magnetic tape, but this is a minor loss compared with the advantages in allowing a transition period.

The program has two entry points. Entered at register 32 (o), the program will first record all of ES on group 0 of the drum, then read in, and enter the general input program from group 7. If the other entry point, at register 35 (o) is used, the TS program will read in and enter a program from group 5. During Group 61 computer periods, group 5 will contain the master control program. It should be noted that a word from register n of ES will go to register n of drum group 0, but that incoming words from register n of drum groups 5 or 7 will arrive at register n+1, or n+2, respectively, of ES.

Programmers can make the input program record on or read in from arbitrary drum groups with arbitrary kinds of correspondence between ES and drum addresses by entering the input program at different points with the proper number in the AC. One such entry will provide magnetic tape read-in ability when the general input program is written.

Operational Details of the Proposed Program

Program operation if the two normal entry points are used is as follows:

a) Register 32(o) entry point:

32. ca 32	Content of AC is 1.00032
33. si 707	Select initial address 32 of drum group 0 to accept output from ES.
34. bo 32	The magnitude of 1.00032 is 0.77745 Record 7745(o) words from ES, starting at register 32 of ES

<u>ES</u>	<u>Group 0</u>
32 →	32
.	.
.	.
.	.
3777 →	3777
0 →	0
.	.
.	.
.	.
3776 →	3776

Final contents of AC is 0.07777

35. sa 35

Content of AC is 1.34034

36. si 703

Select initial address 34 of drum group 7 to read into ES

37. bi 36

The magnitude of 1.34034 is 0.43743

Read in 3743 words to ES, starting at register 36 of ES:

<u>ES</u>	<u>Group 7</u>
36 ←	34
.	.
.	.
.	.
3777 ←	3775
0 ←	3776

Final contents of AC is 0.04001

The program then performs next the instruction in register 40 (o) just read in from the drum.

b) Register 35 (o) entry point, assuming AC contains 0:

35. sa 35

Content of AC is 1.24035

36. si 703

Select initial address 35 of drum group 5 to read into ES

37. bi 36

The magnitude of 1.24035 is 0.53742

Read in 3742 words to ES, starting at register 36 of ES:

<u>ES</u>	<u>Group 5</u>
36 ←	35
.	.
.	.
.	.
.	.
3777 ←	3776

Final content of AC is 0.04000

The program performs next the instruction in register 40 (o).

Other modes of operation result if other entries are used:

c) Register 33 entry point with 1.10032, 1.20032, ..., or 1.50032 in the AC: Operation is the same as in a) except that ES is recorded on groups 2, 4, ..., or 10, respectively.

d) Register 33 entry point with 1.04032, 1.14032, ..., or 1.54032 in the AC:
All but register 3777(o) of ES is recorded on groups 1, 3, ..., or 11, respectively,
and all of drum group 6 reads into ES as follows:

ES	Group 6
36 ←	34
.	.
3777 ←	3775
0 ←	3776
1 ←	3777
2 ←	0
.	.
3777 ←	3775
0 ←	3776

Changing the right eleven digits of the AC in these cases changes both the number of words recorded and the correspondence between drum and ES addresses. Other examples are:

e) Register 36 entry point with 1.00036 in the AC:
All of ES, including the Flip-Flop registers in TS are restored to what they were before a). Similar results can be obtained following c).

f) Register 36 entry point with 1.04036 in the AC:
Registers 36 through 3776 (o) are restored to what they were before d). Similar results can be obtained if the other odd-numbered groups are used.

These examples give an indication of how programmers can use the TS input program to facilitate use of the drum. However, it should be pointed out that some of the drum groups besides 5 and 7 will probably be locked out during computer applications periods for specific purposes.

The Remainder of Test Storage

Most of the remainder of Test Storage not used by the input program will be reserved during computer applications periods for Group 61 purposes. However, registers 0, 1 and 2 can be expected to retain their present contents for both electronic and programming reasons.

During the transition period the program in register 3 → 31 (o) will appear as shown in form DL-687 (attached), essentially as it is now. Sometime after May 1, 1953, this program will no longer be available.

Signed: John M. Frankovich

John M. Frankovich

Approved: CWA

C. W. Adams

JMF:CWA:mmm

INPUT PROGRAM, MAY, 1953

OCTAL

	0	+0x2-15				
6 →	1	+1x2-15			Conditional stop	
	(23)2	Flip Flop Reg #2			(spy)	
	(12,14)3	" " " #3			(word counter)	
	(7,10,20)4	" " " #4			(accumulated sum-mod-one)	
	(21)5	" " " #5			(final sum-mod-one)	
24 →	(11,17)6	" " " #6			(tsx or ck 5 or sp 1 or sp 25)	
	7	sa 4			Add new word to sum-mod-one	
	10	ts 4			Store new sum	
	11	ao 6			Increase tsx instruction by one	
	12	ao 3			Increase word counter by one	
	13	cp 22			If word counter is negative, read in next word	
	16,27 →	14 ts 3			Reset word counter	
		15 rd 15			Read initial word from tape	
		16 cp 14			If word is negative, reset word counter	
		17 ts 6			If word is positive, place it in register 6	
		20 ex 4			Reset sum-mod-one (in case this is a WORD block)	
		21 ts 5			Store previously accumulated sum-mod-one	
					(in case this is a CK block)	
	13 →	22 rd 22			Read word from tape	
		23 ts 2			Place it in register 2 (in case this is an SP block)	
		24 sp 6			Perform next the instruction in register 6	
6, 5-56 Input →	25	si 213			Select photoelectric reader word input	
31 →	26	ca 0			Prepare to reset word counter	
	27	sp 14				
Magnetic Tape Input →	30	si 102			Select magnetic tape unit zero reader forward	
	31	sp 26				
Group 0 Output →	32	ca 32			Select initial address 32 of group 0 to accept block from ES	
Group 7 Input →	33	si 707			Record registers 32 to 3777 and 0 to 3776 of ES on same addresses on drum	
	34	bo 32				
Group 5 Input →	35	sa 35			Record registers 35 to 3777, Record registers 34 to 3776 of drum group 5 in 3776 of drum group 7 in WW registers 36 to 3777, WW registers 36 to 3777 respectively and register 0, resp.	
	36	si 703				
	37	bi 36				

Note: The boxed in areas contain the permanent input program.

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